Information Flow Modeling to Provide Sustainable Cooperation between Educational Institutions and Entrepreneurs

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Abstract: Just as all educational institutions try to complement and customize their study programs and various training modules to meet current and future demand, managers in various fields constantly have to care for their employees, so it is important to realize that one must learn all the time, continuing to acquire new knowledge and competitive skills. For this reason, the above-mentioned parties and the process of lifelong learning should be seen as inseparable entities in order to create a system ensuring the sustainability of information flow and a stable cooperation in the development of skills and ICT competencies. Technologies play an important role in the knowledge management process. The accessibility of information and knowledge is essential together with a thirst for knowledge, perception skills and practical use of knowledge. The work with knowledge implies creation of content: generation of a new knowledge in order to stimulate the development of innovative processes. The goal of the study is to theoretically substantiate and develop a new experience-based knowledge flow model for adult learning by using the latest in technology, as well as to make recommendations for the improvement of sustainable cooperation between institutions of adult education and micro-/small businesses. This publication analyzes the basics of knowledge storage and management, theoretical principles of knowledge flow modeling and a practical example, an elaborate three-level IT training methodology for small and micro-businesses to raise their competitiveness and productivity. The idea of the study is to understand the current situation and get a new perspective on possible solutions for existing problems, as well as to create and offer a support system for organizing the training process at institutions of adult education in the future. This paper examines knowledge flow models and training methodology. To support entrepreneurs and educational institutions, the influence of different conditions and individual's motivation to follow by strategy (i.e. collaborate with others, share with others and grow a business) is essential. In order to find the most efficient experience sharing technology, it is necessary to analyze different knowledge flow models, which will help to understand what information systems need to be used to reach the set goals. The result of the study is an experience-based theoretical knowledge flow model for more efficient knowledge transfer between educational institutions and micro-/small businesses.

Key-Words: information technologies, knowledge management, information flow, adult learning, models of training

1 Introduction

More than a million businesses close down in Europe every year. Data indicates that only 50% of start-up businesses are operational for at least five years.

There is a tendency for micro-/small enterprises to significantly lag behind on the use of ICT skills, technology and e-commerce solutions. It is therefore necessary to envisage training activities that will help to increase the use of ICT, thus ensuring economy of both financial and human resources and easier, more efficient work with customers and suppliers. A competitive personality will develop only through implementation of sustainable education. Knowledge management includes acquiring or creating knowledge, transforming it into a reusable form, retaining it, and finding and reusing it.

Adult learning has been a topical issue at all times, and its importance seems to be increasing in today's technological age. The problem of study is a failure in knowledge flow between institutions of adult education and micro-/small businesses.

The object of study is the development of an information flow model and an effective experience-based learning support system to ensure sustainable cooperation between educational institutions and entrepreneurs.

The goal of the study is to theoretically substantiate and develop a new experience-based
knowledge flow model for adult learning by using the latest in technology, as well as to make recommendations for the improvement of sustainable cooperation between institutions of adult education and micro-/small businesses.

The main study question is what experience-based support system could widen choice of services and improve the efficiency and quality of further knowledge flow between educational institutions and entrepreneurs.

The target audience is executive management team, accountants, customer service specialists, project managers, marketing specialists and other employees – computer users with and without experience.

The idea of the study is to understand the current situation and get a new perspective on possible solutions for existing problems, as well as to create and offer a support system for organizing the training process at institutions of adult education in the future; knowledge flow models and training methodology are examined.

One of the main tasks is to study and understand the needs of entrepreneurs and the necessity for ICT skill acquisition, as well as the current situation and possible solutions to improve the supply of training programs at institutions of adult education.

The result of the study is an experience-based theoretical knowledge flow model for more efficient knowledge transfer between educational institutions and micro-/small businesses.

2 Terms and definitions

Authors of this paper are using some specific terms. It is therefore necessary to explain terms and abbreviations used in this paper.

Definition 1 ICT – information and communication technology.

Definition 2 Small enterprise is defined as an enterprise that employs less than 50 people and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million. [1]

Definition 3 Micro-enterprise is defined as an enterprise which employs less than 10 people and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million. [1]

Definition 4 Innovation is the process by which an idea or invention is translated into a good or service for which people will pay, or something that results from this process. [2]

Definition 5 Knowledge – familiarity with someone or something, which can include facts, information, descriptions, and/or skills acquired through experience or education. It can refer to the theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject); and it can be more or less formal or systematic. [3]

Definition 7 Knowledge management is the name of a concept in which an enterprise consciously and comprehensively gathers, organizes, shares, and analyzes its knowledge in terms of resources, documents, and people skills. [4]

Definition 8 Information flow – path data takes from its original setting to its end users. [5]

3. Knowledge management process

It is a systematic process that focuses on the acquisition, transfer and use of effective, topical knowledge and best practice, thus promoting sustainable operation of organization. In order to manage knowledge, it first needs to be created (e.g. by learning), gathered (from conversations with other people, written sources, etc.), synthesized and combined together. After all pieces of knowledge are collected, they are accumulated.

In order to find the most effective data management technology, it is necessary to study different knowledge sharing methods, which will help to understand what information systems need to be used to reach the set goals. There is an important shift in business activities focus from remembering large amounts of information to developing one's ability to solve problems and quickly find the necessary information. [6]

Having regard of the wide availability of information, structurization of information is necessary in order to stimulate cooperation between educational institutions and entrepreneurs.

An intelligent organization is able to mobilize the different kinds of knowledge that exist within it to enhance the performance. It pursues goals in a changing environment by adapting behavior according to knowledge about itself and the world it thrives in. An intelligent organization is therefore a learning body skilled at creating, acquiring, organizing, expanding, renewing, and sharing knowledge, and applying this knowledge to design its behavior. [7]

3.1. Knowledge storage in KM

Carroll [8] describes knowledge repository as a database where information is regularly systematized in order to facilitate its search and retrieval. So knowledge repositories are structured databases, yet it should be noted that the largest proportion of data on the web is non-structured.

Data is organized into information by combining it with prior knowledge and the person's self-system to create a knowledge or mental representation [9]

Knowledge can be stored in:

- Books
- Knowledge bases
- Wikipedia
- Libraries
- Memory
- Knowledge representation (AI)

Authors are more interested in knowledge representation (KR) as it is an area of artificial intelligence research aimed at representing...
knowledge in symbols to facilitate inference from those knowledge elements, creating new elements of knowledge. The KR can be made to be independent of the underlying knowledge model or knowledge base system (KBS) such as a semantic network.

One problem in knowledge representation is how to store and manipulate knowledge in an information system in a formal way so that it may be used by mechanisms to accomplish a given task. Examples of applications are expert systems, machine translation systems, computer-aided maintenance systems and information retrieval systems (including database front-ends).[10]

3.2. The structurization of information for knowledge sharing

The key challenge in experience-based learning system is to encourage knowledge sharing through participation and engagement in various forms in order to better organize structurization of information and ensure the flow of knowledge between educational institutions and entrepreneurs who don’t have motivation and free time to acquire new knowledge.

The success of knowledge sharing initiatives depends on structurization of information. It is important to note that there is a large body of research focusing on information sampling and how unshared information is pooled to facilitate group decision-making that might be useful for studying knowledge sharing in teams [11, 12, 13, 14].

It may seem that creating a vast variety of knowledge management systems will help us solve the problems of knowledge accumulation. Unfortunately, this will not happen for several aspects (both technological and psychological) preventing it. Therefore, the authors have made the following summary based on the recommendations of other authors [15]:

<table>
<thead>
<tr>
<th>Technological aspects</th>
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<tbody>
<tr>
<td>• Data, information and knowledge</td>
</tr>
<tr>
<td>• Structured (databases)</td>
</tr>
<tr>
<td>• Partly structured (texts, diagrams, e-mails)</td>
</tr>
<tr>
<td>• Non-structured (hand-written notes, printouts, video files, pictures, voice mails, texts)</td>
</tr>
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<table>
<thead>
<tr>
<th>Psychological aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Abundance of information and conflicting / contradictory data</td>
</tr>
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| • Difficulty in finding the necessary information |
| • Difficulty in sharing the knowledge acquired by long experience |

First it is necessary to find out how participants acquire new knowledge. Studies show that there are major differences in how people acquire knowledge, i.e. learn. Riechmann [16] has identified six learning styles:

- Competitive – learning material in order to perform better than other students in the class;
- Collaborative – believing that one can learn by cooperating, sharing their ideas and talents;
- Avoidant – not enthusiastic about learning in a traditional way;
- Participant – eager to learn, loving lectures;
- Dependent – showing little intellectual curiosity, looking for specific guidelines on what to do (needs support);
- Independent – preferring to think for themselves.

Cross [17] in her work points out that people would be more productive if they learned by using methods that suit their learning style.

In most cases people nowadays:

- Like to manage acquisition of new knowledge on their own;
- Want to be actively involved in the learning process;
- Want to link newly acquired things with those previously known;
- Want to link newly acquired knowledge with the real world. [18]

Important factors are the availability of information, one’s willingness to know where to find it and the ability to perceive, use and combine it.

Taking into account the importance of information structuring, the authors created an extended model (Fig. 1) based on the stages of Kolb’s adult learning cycle [19], which have been supplemented with the theoretical bocks of knowledge management processes [20].

4 Principles for constructing a knowledge flow model

Within the framework of the study, a new model based on Kolb’s adult learning cycle has been developed supplemented with the theoretical building blocks of knowledge management.

The Kolb’s cycle comprises four different stages:

- Concrete Experience;
- Reflective Observation;
- Abstract Conceptualization;
- Active Experimentation. [19]

This inner cycle depicts the four stages of the learning process. The other model is knowledge conversion processes SECI (Socialization, Externalization, Combination, and Internalization).
There are four kinds of context in which knowledge is shared:
- Socialization (tacit to tacit);
- Externalization (tacit to explicit);
- Combination (explicit to explicit);
- Internalization (explicit to tacit).

The outer cycle depicts information processing and how tacit knowledge becomes explicit. [20]

The two models are combined together to highlight the learning process as a whole basis, supplemented by the knowledge management building blocks. This approach allows a better understanding of how work with information is organized and how information transforms into knowledge.

The authors have included additional theoretical building blocks in their model, such as structurization of information for group work. This was necessary to more clearly depict the process of how individual knowledge turns into group knowledge. [21]

The improved model will help one understand:
- How the group benefits from each individual's contribution in the Externalization stage;
- How the collective understanding of the study process forms, taking into account each group member's individual learning style;
- The flow of information and the basic principles of knowledge formation in an online environment both in individual and group cooperation process with an aim to determine the level of group cooperation.

It is necessary to test this model in an experimental group. Under such conditions, it would be possible to prove that the model described herein will help to achieve the set goal.

5 Experience-based learning model

Kolb developed a theory of experiential learning that can give us a useful model by which to develop our practice. This is called The Kolb Cycle, The Learning Cycle or The Experiential Learning Cycle. The cycle comprises four different stages of learning from experience and can be entered at any point, however, all stages must be followed in sequence for successful learning to take place.
- Concrete Experience (doing / having an experience);
- Reflective Observation (reviewing / reflecting on the experience);
- Abstract Conceptualization (concluding / learning from the experience);
- Active Experimentation (planning / trying out what you have learned).

The Learning Cycle suggests that it is not sufficient to have an experience in order to learn. It is necessary to reflect on the experience to make generalizations and formulate concepts which can then be applied to new situations. [19]

Around this Kolb’s Experiential Learning Cycle are knowledge conversion processes (SECI). There are four kinds of context in which knowledge is shared supporting these four processes (I – individuals, G – groups, O - organizations):
- Socialization (tacit to tacit): involves the sharing of tacit knowledge between individuals through joint activities rather than the sharing of knowledge via written or verbal instructions;
- Externalization (tacit to explicit): involves the expression of tacit knowledge and its conversion into comprehensible forms that are easier to understand by others (explicit knowledge);
- Combination (explicit to explicit): involves the conversion of explicit knowledge (created during externalization) into more complex sets of explicit knowledge, with communication and diffusion being the key areas of focus;
- Internalization (explicit to tacit): is the conversion of explicit knowledge into tacit knowledge.

According to Nonaka and Takeuchi, success of knowledge management (KM) within an organization is related, on the one hand, to the conversion of internalized tacit knowledge into explicit codified knowledge in order to be shared, but also, on the other hand, for individuals and groups to internalize and make the codified knowledge personally meaningful [19]. The authors have developed such a model to describe the factors influencing structurization of information for group work and knowledge sharing between individuals as good as possible (Fig. 1).

![Fig. 1 Experience-based Learning Model][1]
then, as a result of this experience, the information gained should be treated as tacit knowledge, which must first be converted into concepts, graphs or any other form of explicit knowledge. Explicit knowledge starts to make sense in the next stage of the learning process, combining it with the existing knowledge of other participants involved in the learning process, making generalizations and understanding their interrelationship in general. Based on acquired interconnection, the next stage in the learning process is planning and carrying out new experiments in order to verify, clarify or extend knowledge. At this point, information obtained during current learning cycle has already become individual knowledge of each participant of the learning process. Working together through the planned research, participants of the learning process share tacit knowledge and obtain new information at the same time; this is the beginning of the next learning cycle. Chua [22] believes that the level of social interaction between group members positively influences the quality of created information.

Different authors in their studies admit that learning which has undergone all four SECI processes is the most efficient. By this newly-developed model, we would like to emphasize that the process of learning is like a core supplemented by the theoretical blocks of knowledge management and that both individual’s contribution and cooperation between group members play an essential role in knowledge creation.

6 Training methodology

The methodology and cooperation strategy between institutions of adult education and businesses was improved on the basis of currently established models and methodologies, in consultation with experts in various fields, as well as by polling adults representing different age groups, social classes and professions. There was organized a three-level training course for micro-/small businesses to prove the practical application of the knowledge flow model.

1st-level training to improve digital skills and raise the productivity of ICT solutions. One-day training seminar with practical demonstrations on digital solutions ensuring increased productivity of MSB. To motivate entrepreneurs to take part, at the beginning of the seminar they were offered to perform:

- a test to determine the company's ICT level (e-maturity);
- individual assessment of each employee of the company.

2nd-level training – use of ICT tools for the competitiveness and development of MSB. 10 combined (practical and theoretical) training courses for optimization of business processes and improvement of work efficiency. Practical training opens up an opportunity to learn how to use technology tools for planning, support and analysis of above-mentioned processes.

3rd-level training – use of ICT solutions for increased business efficiency and export expansion.

As entrepreneurs have different levels of knowledge, we assume that the user can select any of the available courses at any level of difficulty after logging into the system.

7 Conclusion and future work

Educational institution or organization is an open system. Open systems are complex systems which take information, material and energy from the external environment and transform these resources into knowledge, processes and structures that produce goods and services. Due to this, complex systems are usually out of balance: in spite of the seeming stability, the system is constantly changing.

Knowledge management gives priority to the way in which people construct and use knowledge. It derives its ideas from complex systems, often making use of organic metaphors to describe knowledge growth. [3]

This study provides a theoretical framework based on Kolb’s Experiential Learning Cycle and knowledge conversion processes SECI to ensure more successful structurization of information and knowledge sharing process. Information and communication technology innovations open up tremendous opportunities for knowledge management —both in obtaining, structurization and conversion of information, and knowledge creation and exchange.

The result of the study is an experience-based theoretical knowledge flow model for more efficient knowledge transfer between educational institutions and micro-/small businesses. The system based on such a model must be self-developing, so stable that it succeeds in identifying when a fault has occurred to correct it immediately. The next step is to improve the real learning information system, strengthen internally and externally focused knowledge sharing activities, as well as to characterize the highest average level of cooperation between educational institutions and entrepreneurs. In this case, the use of newly-developed experience-based learning model is essential.

In order to ensure a successful flow of knowledge for both parties, various aspects should be taken into consideration:

1) New entrepreneurs have innovative ideas, yet they lack the necessary ICT skills to implement their ideas.
2) Motivation mostly depends on the availability of technologies and the quality of services.
3) The development of successful cooperation is a very slow process; in best case, mutual trust can be achieved in 2 years.
4) Entrepreneurs should gain the trust of educational institutions, precisely explaining what and how
much needs to be invested and what potential benefits of this process are.
5) Innovations in the learning process need to be real and simple enough to help the business find a way to solve its problems.
6) The content of courses must be developed by entrepreneurs to get benefit for their business as fast as possible. The faster entrepreneurs fit in the learning environment, the more productive they can work. Fitting in includes the awareness of new opportunities, the use of other people’s experience, as well as identification with the learning environment. ICT can directly influence such key future success factors as creativity and the innovation skill, which are the main resources to fuel competitiveness and growth.

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